8-100

ENGINEERING-SCIENCE, INC.

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000022856

MEETING NOTES

TO: Distribution

DATE: January 11, 1994

FROM: Philip Nixon

MEMO #: SP307:0194:01

PROJECT #: Solar Pond IM/IRA

ATTENDANCE:

Randy Ogg, EG&G
Harlen Ainscough, CDH
Phil Nixon, ES
Richard Henry, ES
Andy Ledford, EG&G
Alan MacGregor, ERM
Dave Ericson, EG&G
Scott Surouchak, DOE
Peg Witherill, DOE
Arturo Duran, EPA
Ted Kearns, DOE/KMI
Steve Paris, EG&G
Lee Pivonka, G&M
Cindy Gee, ES
Rich Stegen, ES
Steve Howard, DOE/SMS
John Hasbeek, ERM

DISTRIBUTION:

Attendees
L. Benson
A. Conklin
P. Breen
H. Heidkamp
K. Cutter
S. Stenseng
A. Fricke
T. Kuykendall
T. Evans
B. Cropper
C. Montes
R. McConn
W. Edmonson
B. Wallace EG&G (Admin. Record) (2)
K. London, EG&G
Martin McBride
Helen Belencan, DOE
Steve Cook
Joe Schieffelin, CDH
Bob Segris, LATO
Steve Keith, EG&G
Dave Myers, ES
R. Wilkinson, ES
S. Winston, ES
Frazer Lockhart, DOE
Mark Austin, EG&G
Kim Ruger, EG&G
Michelle McKee, EG&G
Marcia Dibiasi, IGO

1) **Previous Minutes Review**

It was discussed that some surface soils north of the seepline will be remediated as part of the IM/IRA. The strategy has changed such that soils will be remediated unless the source of contamination is groundwater. Soils with the potential to be contaminated by groundwater will be addressed through the Phase II additional hydrogeologic investigations.

It was discussed that EG&G was going to send a survey crew into the field to identify and mark the OU4 boundaries. EG&G will propose these boundaries to EPA/CDH for concurrence. **ES will work with EG&G to define the areas that will be remediated as part of the IM/IRA.** Arturo Duran specified that DOE should maximize the area that is remediated; however, DOE is not expected to remediate areas where there are physical or logistical constraints.

It was agreed that a fence or signs would be required around the engineered cover's perimeter to restrict access.

It was discussed and agreed that Bowman's Pond was included in OU4 and would be addressed in the Phase II hydrogeological program.

Sampling and chemical analysis for verification that an area could be clean closed (during construction) was discussed. It was agreed that the IM/IRA-decision document would contain a plan for this verification sampling. Analysis would be performed for the specific COCs that had concentrations exceeding the PRGs in that area. The sampling and analysis needs to be completed very quickly so that construction activities are not held-up. **ES will investigate mobile laboratories that could be brought to the site during construction. A mobile lab will be required to be able to detect COC concentrations at the vadose zone PRG level. In addition, the analytical results will need to meet or exceed the appropriate data quality level.** If field testing can support these requirements, then no additional samples would need to be sent to an off site lab for confirmation. If field testing cannot meet the data quality level objectives, then additional confirmation samples would need to be sent to an off site laboratory.

The previous agreement that excavated utilities could be consolidated under the engineered cover was upheld. **Harlen Ainscough ES will investigate through sources at CDH whether the debris rule will be the regulatory mechanism which enables this consolidation, or whether the CAMU concept will be the consolidation mechanism.** Andy Ledford pointed out that the original process waste lines (OPWLs) should be removed from areas that will be clean closed.

The conceptual design part of the IM/IRA-decision document (IV) will specify that the design should consider responses for upset conditions such as excavating a utility line that

contains or spills liquids. This might include references to existing RFP Standard Operating Procedures.

2) **Schedule Review**

Andy Ledford discussed the project schedule. The roundtable review draft will be provided to the project team on the afternoon of February 14, 1994. Each weekly meeting thereafter will focus on comments from a specific part of the IM/IRA-decision document. Andy Ledford requested that comments be submitted in writing (or marked-up sections may be provided). Only major comments should be addressed at the meetings so that they can be expedited.

The following schedule provides the meeting dates for addressing comments on the specific parts:

February 15, 1994	-	Kickoff meeting
February 22, 1994	-	Part I/Part II
March 1, 1994	-	Part III
March 8, 1994	-	Part IV
March 15, 1994	-	Part V
March 22, 1994	-	Part VI

3) **Permitting Issues - Building 788**

Ted Kearns presented issues to discuss concerning the removal of Building 788. Arturo indicated that the removal of Building 788 was originally included in the IM/IRA. EPA/CDH had agreed to potentially consider addressing Building 788 outside the IM/IRA if DOE thought that this could expedite the removal. **EPA, however, expects to receive a draft closure/removal plan on April 14, 1994.**

A separate meeting was tentatively scheduled to discuss the removal of Building 788 on January 24, 1994. A summary of the key issues is presented below.

- Could the building be relocated and keep its RCRA storage permit intact. Harlan Ainscough indicated that this is highly unlikely. Steve Howard indicated that perhaps Building 788 could be used as an addition to an existing waste storage facility to allow the existing facility to achieve its permitted capacity. **Harlen indicated that this might be possible, and that he would investigate this potential.**

- Harlen Ainscough indicated that RCRA Unit 21 would require closure as part of the Building 788 removal.

- Consolidation of Building 788 rubble/debris under the IM/IRA engineered cover might be technically feasible as long as the material could be size-reduced such that the cover compaction requirements could be achieved. Harlen Ainscough indicated that CDH might be willing to consider this.

4) **Schedule/Budget Impacts of Current Barrier Design**

Dave Ericson provided an analysis of the impacts from four engineered cover design alternatives:

1. Baseline - remove liners and cover the entire SEP area with a RCRA type cover.

2. Option A - provide a 1000 year engineered cover over the entire SEP area.

3. Option B - consolidate liners under a 1000 year cover with excavated areas receiving a RCRA cover.

4. Option C - consolidate liners and contaminated soils under a 1000 year engineered cover and clean close the excavated area.

It was discussed that the baseline and option A were the least desirable alternatives due to construction difficulty, total cost, and hillside stability concerns. Option C appears to be the most desirable alternative with respect to the ease of construction, total cost and ability to meet the IAG April 14, 1994 milestone; however, there is some risk associated with option C with respect to being able to clean close the excavated SEPs. Subsurface soil concentrations will not be available for SEP 207-C until late spring/early summer (1994). The design will be at the 60% complete stage when the 207-C Pond data is received, and approximately $50,000 worth of engineering may need to be redone if the data indicates that C-Pond cannot be clean closed. DOE is at a risk of $50,000 in engineering costs for a potential savings of $5 million in construction costs. Scott Surouchak indicated that spending an extra $50,000 to potentially save $5 million was acceptable. **EG&G/DOE will discuss the potential for performing a design for both option B and option C.**

5) **Ground Water Issues Associated with the 1000 Year Criteria.**

Richard Henry presented hydrographs showing water levels in monitoring wells adjacent to the SEPs. The data covers the period from 1987 to 1993. The hydrographs indicated that the water table levels under 207-B South have risen above the elevation of the liner base during periods of peak rainfall/snowmelt. Ponding of water under the SEPs is possible due to leakage from the SEPs and low permeability soils. This hypothesis is supported by the fact that the soil moisture content in pond berm soils were close to the saturation levels. When the SEPs are emptied and closed, the water table mounding may recede.

Harlen Ainscough suggested that the elevation of the seepline be examined to determine if the B-series Ponds were constructed beneath the water table elevation.

The location of the proposed engineered cover may not be located in the optimum area due to this water table elevation data. Potential alternatives considered to address this issue were:

1) remove the liners and contaminated soils,

2) provide a groundwater remedy with the proposed engineered cover alternative,

3) Reconfigure the engineered cover to SEP 207A to avoid covering the region where the water table level is potentially high.

4) demonstrate that groundwater contact does not leach COCs to unacceptable levels in groundwater,

5) challenge the applicability of the Colorado Hazardous Waste landfill siting criteria with respect to their applicability to the closure of the SEPs,

6) demonstrate that the Solar Evaporation Pond closure will lower the water level and increase the depth of the vadose zone, and

7) provide a temporary IM/IRA and address the final closure/remediation after the site hydrogeology is understood.

It was discussed that the modeling needed to be performed to predict whether COCs could be leached if ground water (or infiltration) came into contact with wastes. If it could be demonstrated that contaminants would not leach, or if leachate concentrations to ground water would be protective of human health and the environment, then it may not be necessary to change the cover location or install a ground water control mechanism. ES will consider changing the location of the 1000 year cover and will continue the VLEACH modeling effort. TCLP-type analysis may be considered if samples already exist that can be analyzed quickly. This would provide actual leachate results that could be used to compare against modeled results.

Philip Nixon, Project Manager

Attachment 1
SP307:0194:01
page 1 of 1

OPERABLE UNIT 4/SOLAR EVAPORATION PONDS

JANUARY 18, 1994

AGENDA

BASELINE OVERVIEW-ES	8:00-8:15
POND 207 B-SERIES-CLEAN CLOSURE POND 207 C-RCRA EQUIVALENT CAP 1000 YEAR AREAL EXTENT	
DESIGN MODIFICATIONS-ES	8:15-8:45
COC LEACHING EVALUATION-ES	8:45-9:15
BREAK	9:15-9:30
CONCEPTUAL DESIGN-ES	9:30-10:00
DISTRIBUTION OF POST CLOSURE MONITORING AND MAINTENANCE PLAN-ANNOTATED OUTLINE	
OPEN ISSUES	

Presentation Concerning the Depth to Water Table Issue
January 18, 1994

- Overview - Phil Nixon
- Design Modification - Sandy Stenseng
- COC Leaching Evaluation - Leigh Benson
- Path Forward for CDR - Phil Nixon

Attachment 2
SP307: 01 94:01
Page 1 of 8

Overview

Issue Statement

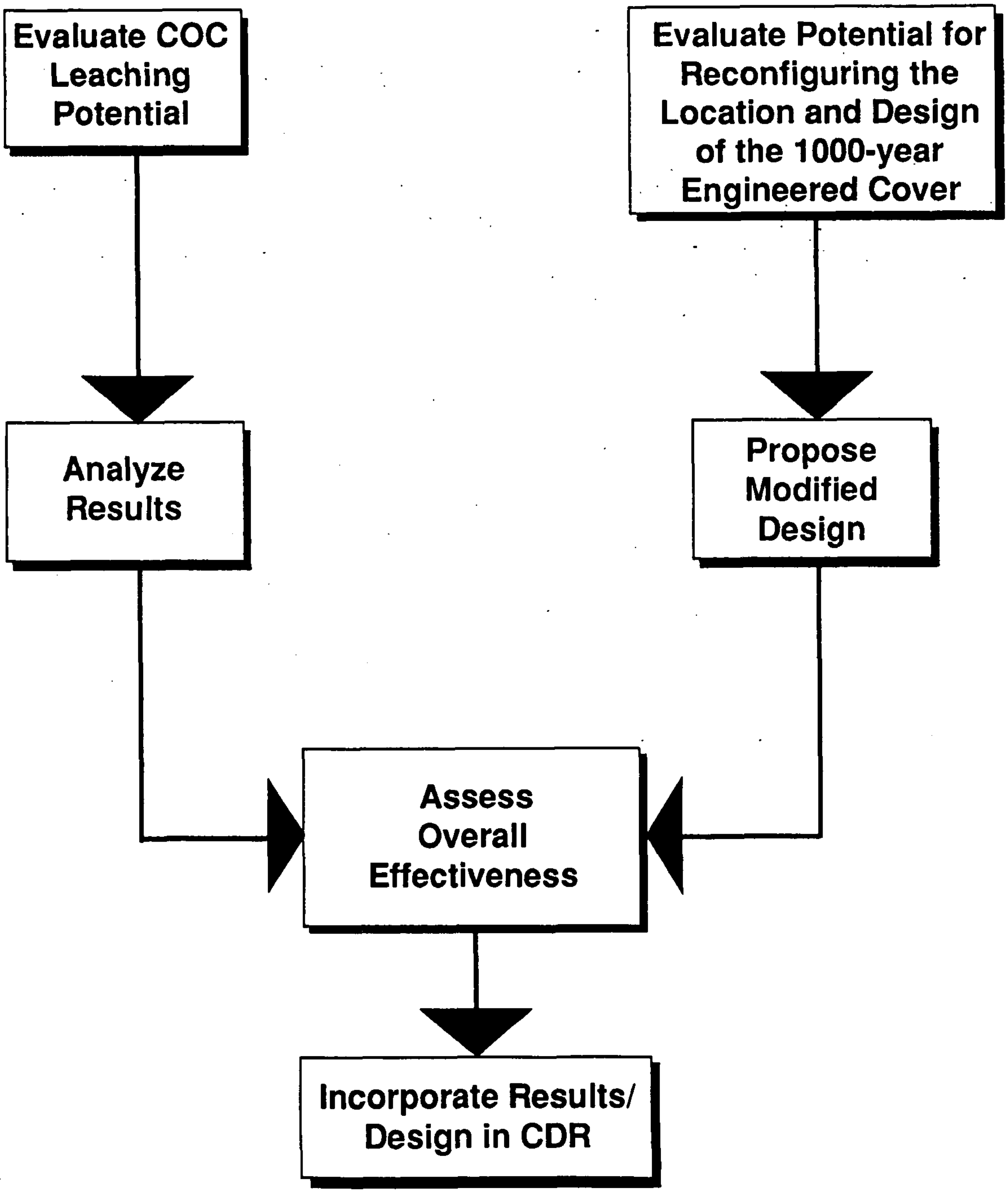
- The proposed configuration of the 1000-year engineered cover, covered a region of the B-series SEPs where the seasonal water table elevation has historically been higher than the pond liner elevation.

Resolution Strategy

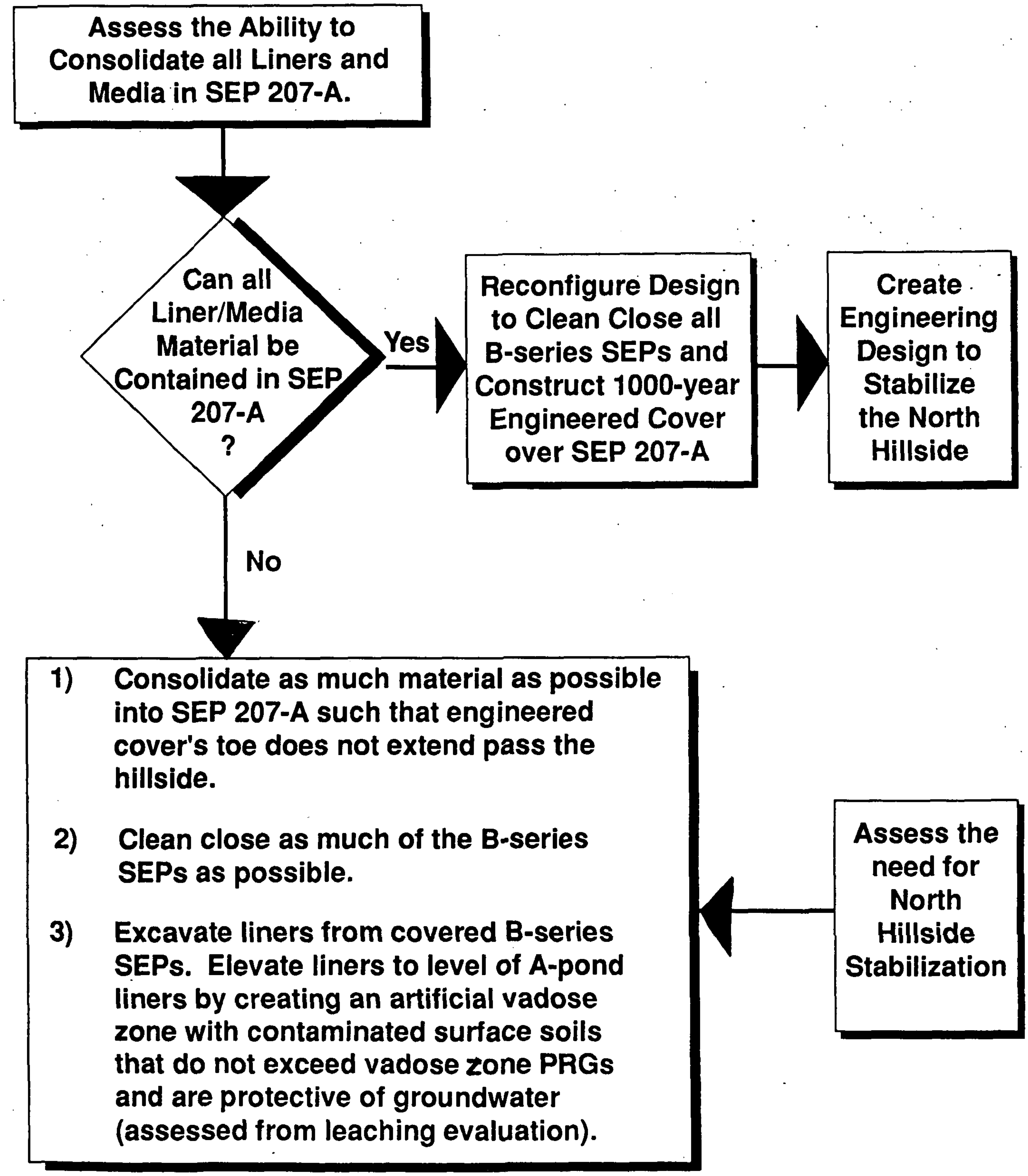
1) Evaluate reconfiguring the location of the 1000-year engineered barrier

2) Evaluate the potential for leaching to occur and assess the potential impacts of leachate on the groundwater

Programatic Path Forward to Address Potential High Water Table Elevation Concerns



Evaluation of Engineering Design



Design Assumptions for Agreement/Concurrence

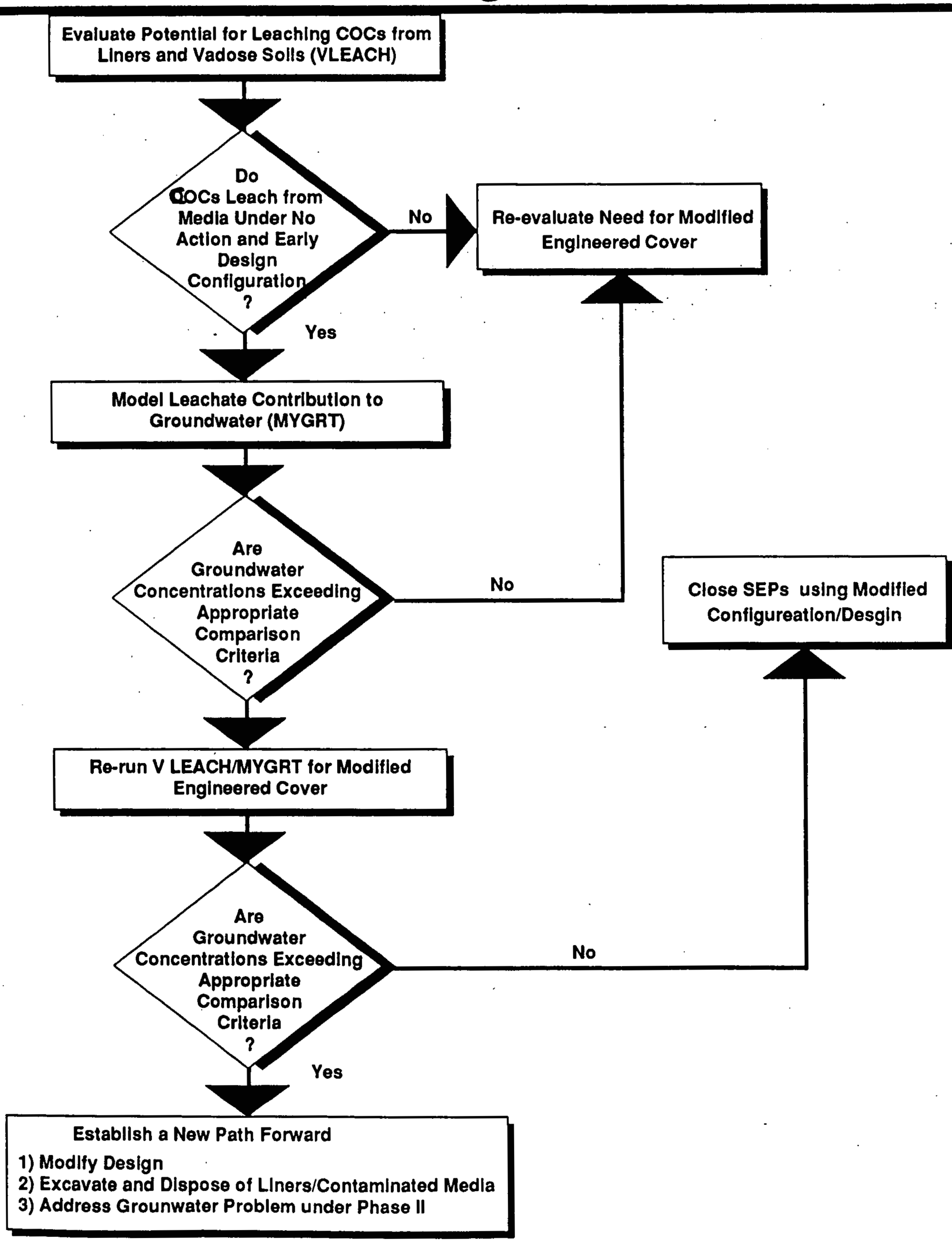
1) Raising B-series pond liners under the engineered cover to a level equal to the A-pond liners will provide an adequate vadose zone.

2) Contaminated surface soils may be used to create the artifical vadose zone if the COC concentrations are less than vadose zone PRGs and are protective of groundwater as assessed by the leaching model.

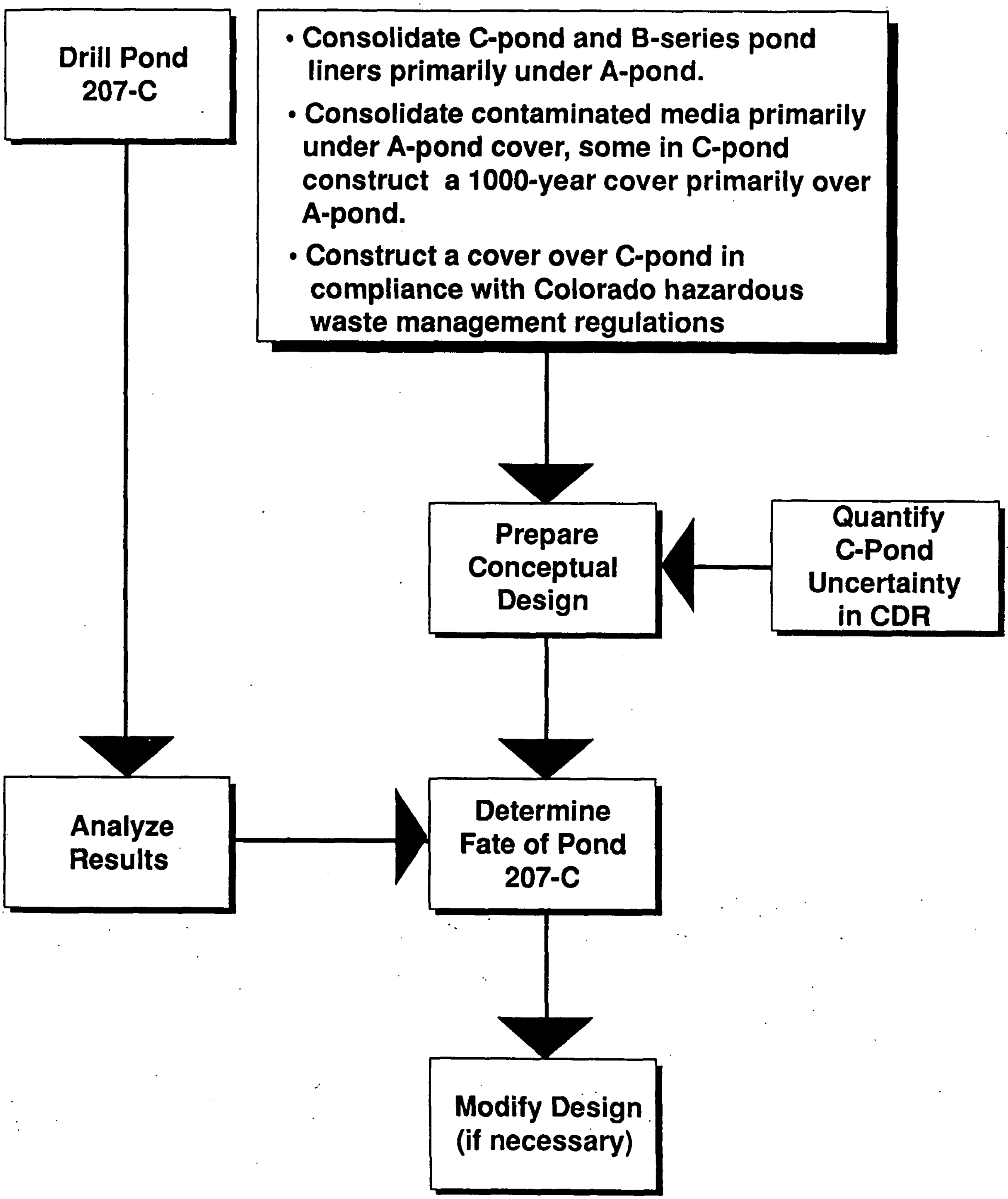
3) Contaminated soil media may also be consolidated under SEP 207-C to establish a grade for an engineered cover in compliance with the hazardous waste management regulations. If the COC concentrations are less than vadose zone PRGs and are protective of groundwater as assessed by the leaching model.

4) The vadose zone has been defined as the unsaturated region from the ground surface to the historical high water table elevation. Phase II will address the region below the historical high water table elevation.

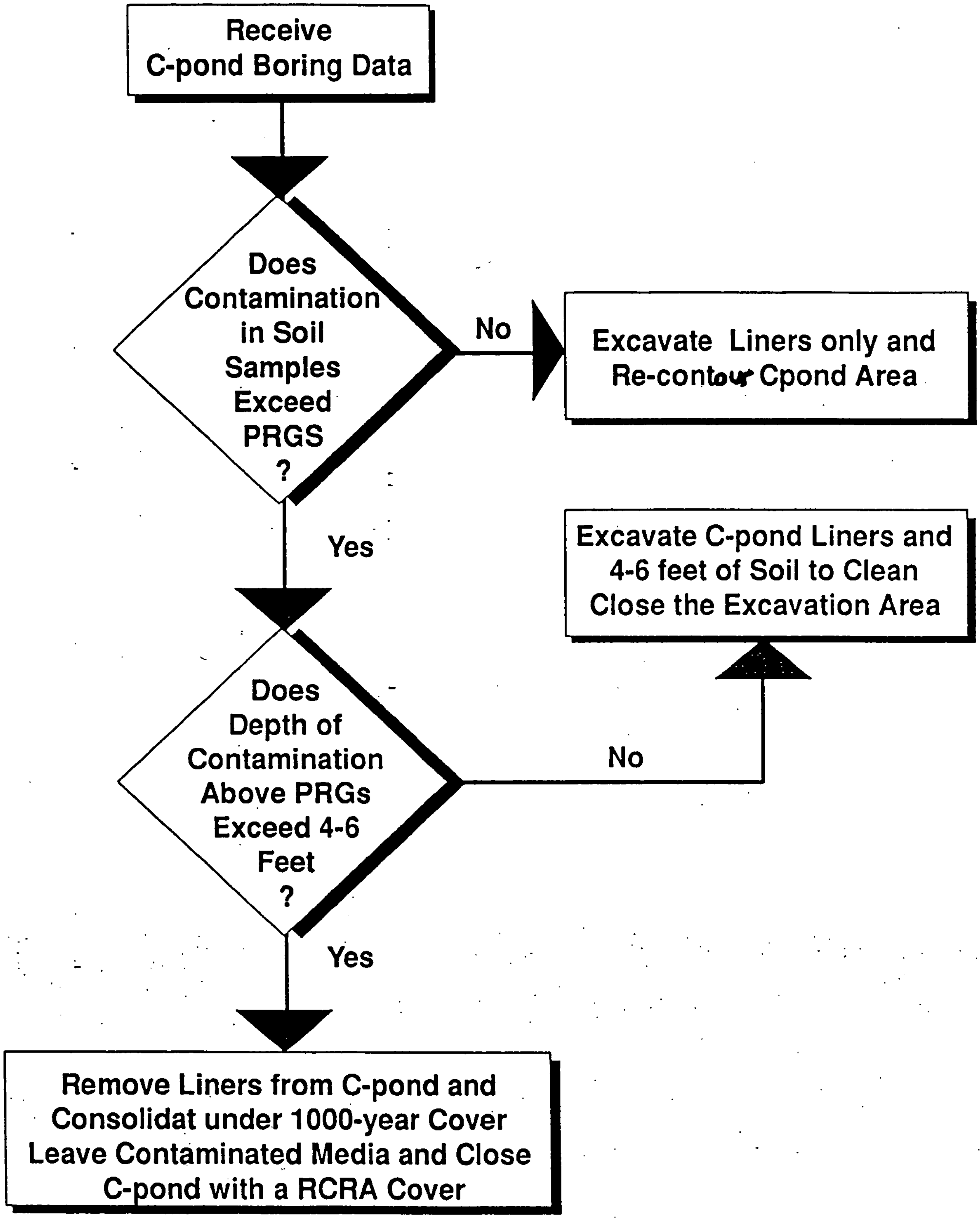
Evaluation of Leaching



CDR Path Forward Flowsheet



Decision Flowsheet for C-pond Uncertainty



Attachment 3
SP307: 01 94:01
Page 1 of 17

EcoTek LSI
EcoTek Laboratory Services Incorporated

- Fax Cover Sheet -

Date: 1/17/94

Pages:

To: Ms. Rebecca L. Cropper

Fax Phone: 303-831-8208

From: Mr. Ronald D. Taritas Ron

Subject: Mobile Lab Information

Please call with any questions

Ronald D. Taritas
Director of Sales & Marketing

EcoTek LSI
EcoTek Laboratory Services Incorporated

3342 International Park Drive, S.E.
Atlanta, Georgia 30316
(404) 244-0827 • Fax # (404) 243-5355

Attachment 3
SP307: 01 94:01
Page 2 of 17

Mobile Analytical Laboratories

Perform complex laboratory analysis onsite!

- The MLS is designed for regulatory compliance as applicable, for:
  - DOE
  - EPA
  - DOD
  - NRC
- Engineered facilities have been provided for:
  - US EPA REM II Program/CH2M-Hill
  - US EPA ARCS Program/NUS
  - DOD/USMC Barstow Logistics Center
  - DOE/Westinghouse Hanford Company (current contract)
- NFS-RPS can supply a *complete* package:
  - Design
  - Facility
  - Equipment
  - Systems
  - Staffing
  - Training
  - Field Management

Please Detach and Return Today!

FROM:
675-A Emory Valley Road
Oak Ridge, TN 37830

29¢ Postage Required

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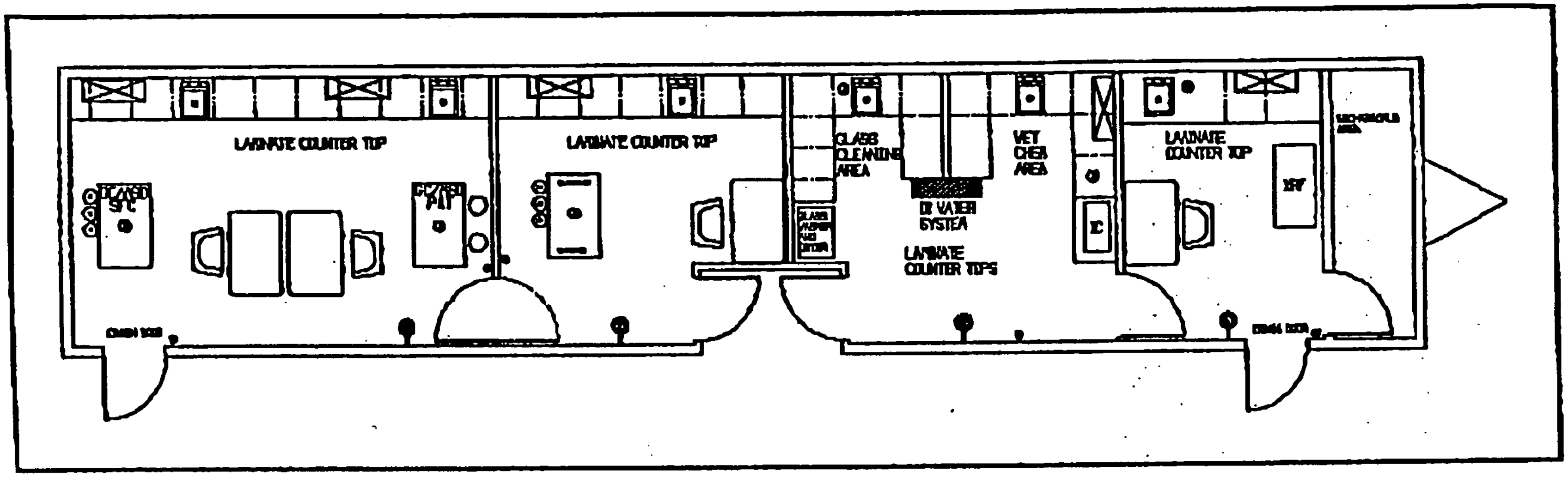
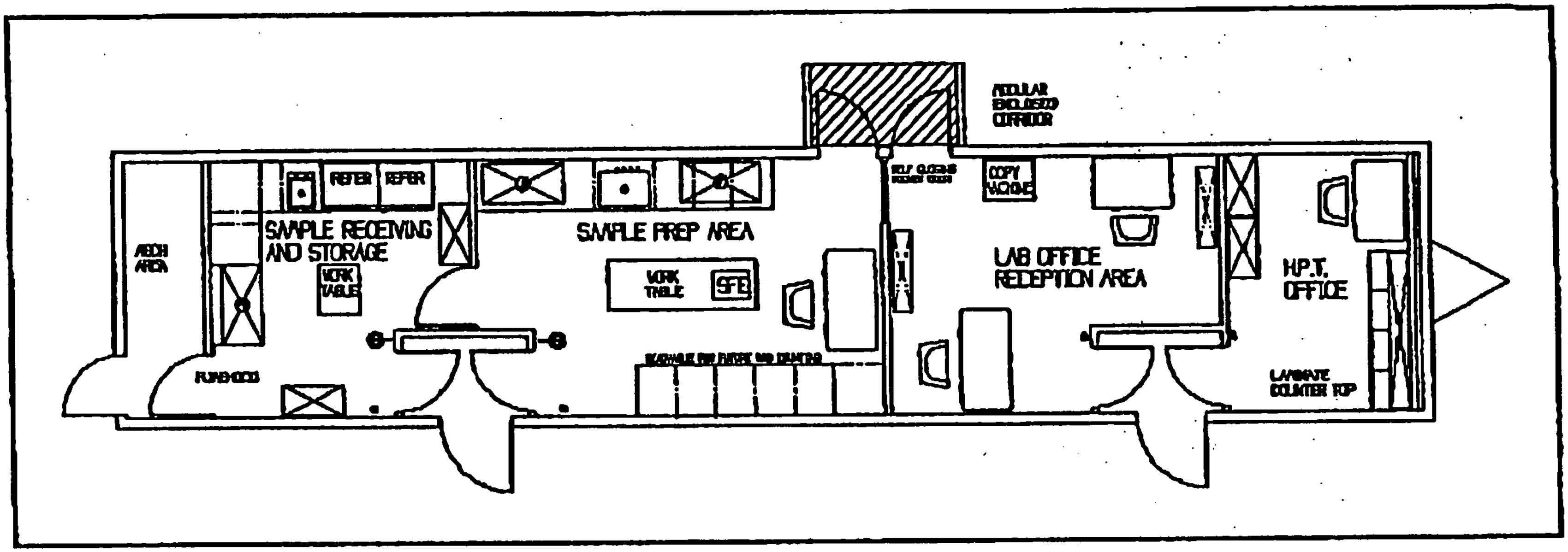
Example layouts: Analytical lab facility



Constructed for DOE and Westinghouse Hanford Co. --
Awarded FY92

Example layouts: Sample prep. facility

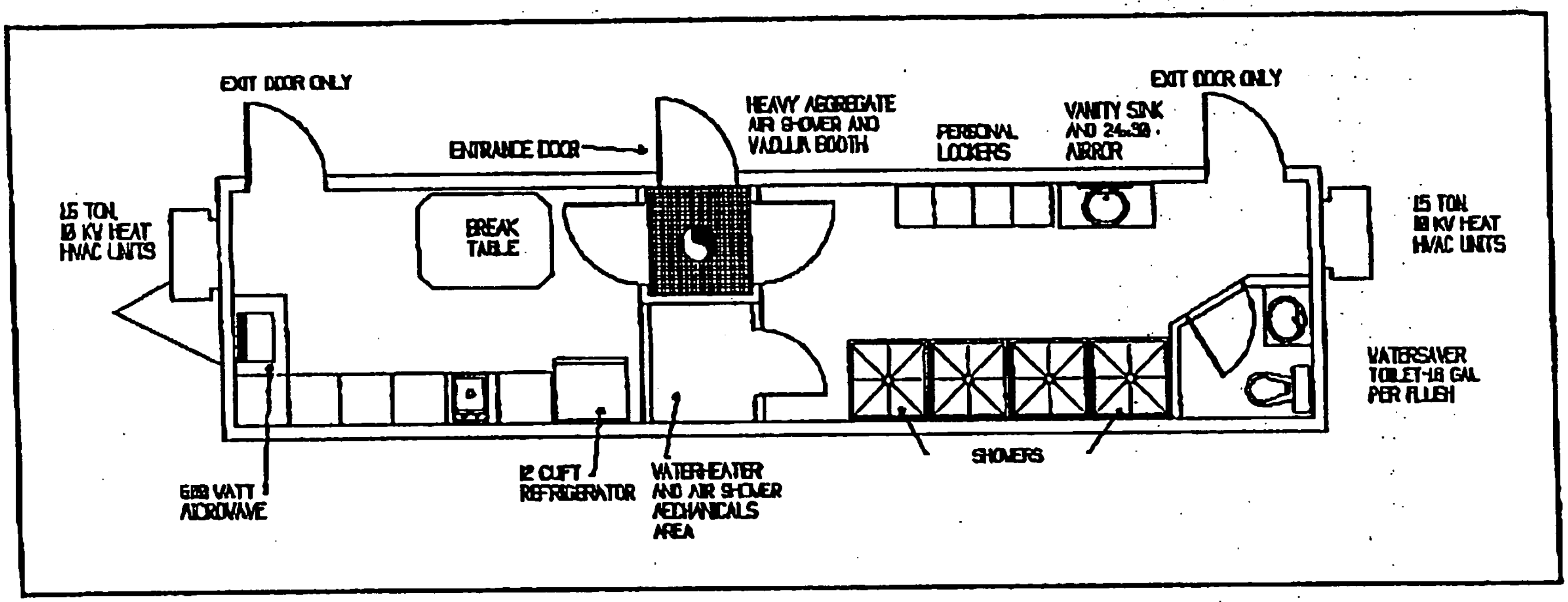


Constructed for DOE and Westinghouse Hanford Co. --
Awarded FY92

NFSystems

Modular Laboratory System

Example layouts: Decon facility

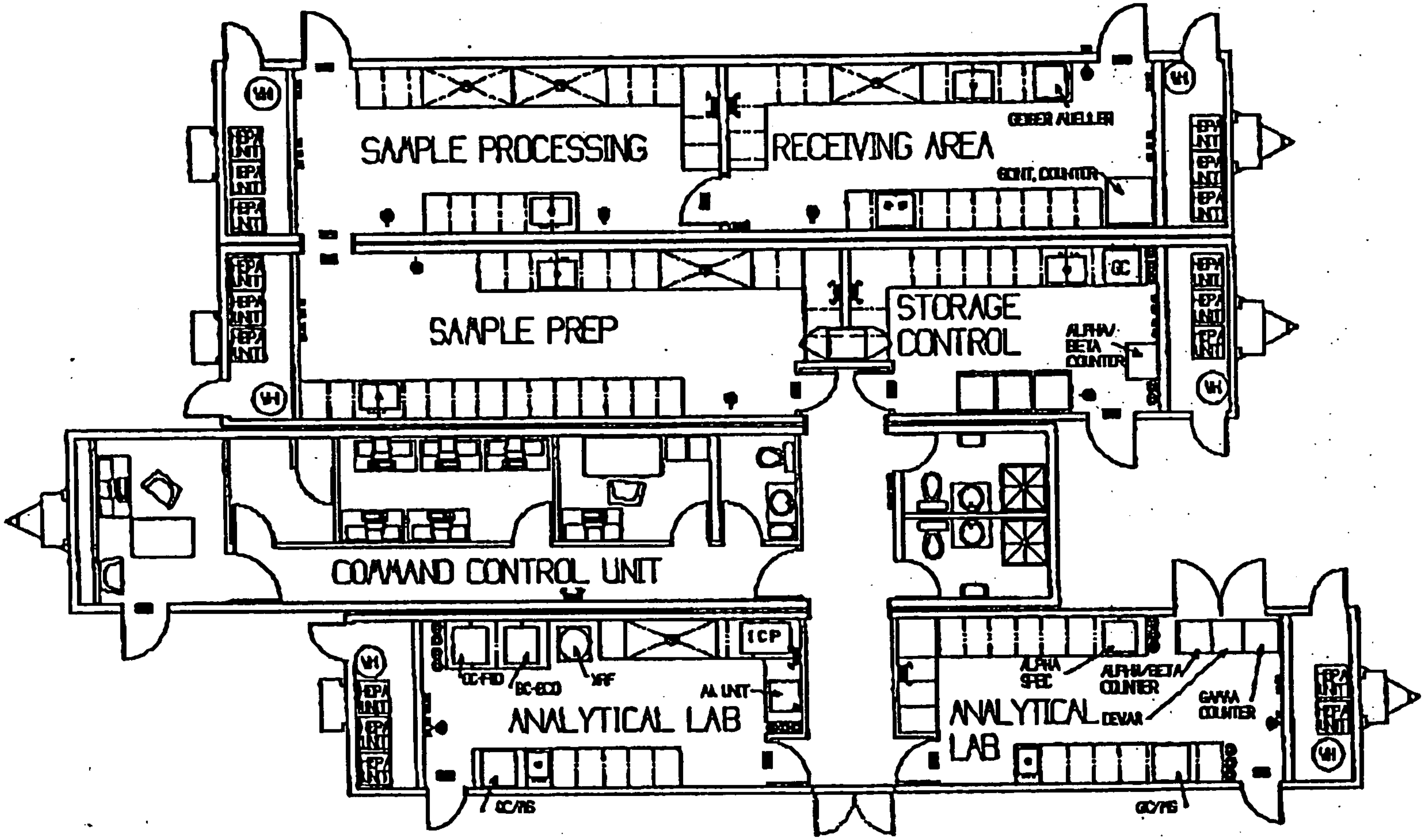


Constructed for DOE and Westinghouse Hanford Co. -- Awarded FY92

NFSystems

Modular Laboratory System

Example layouts

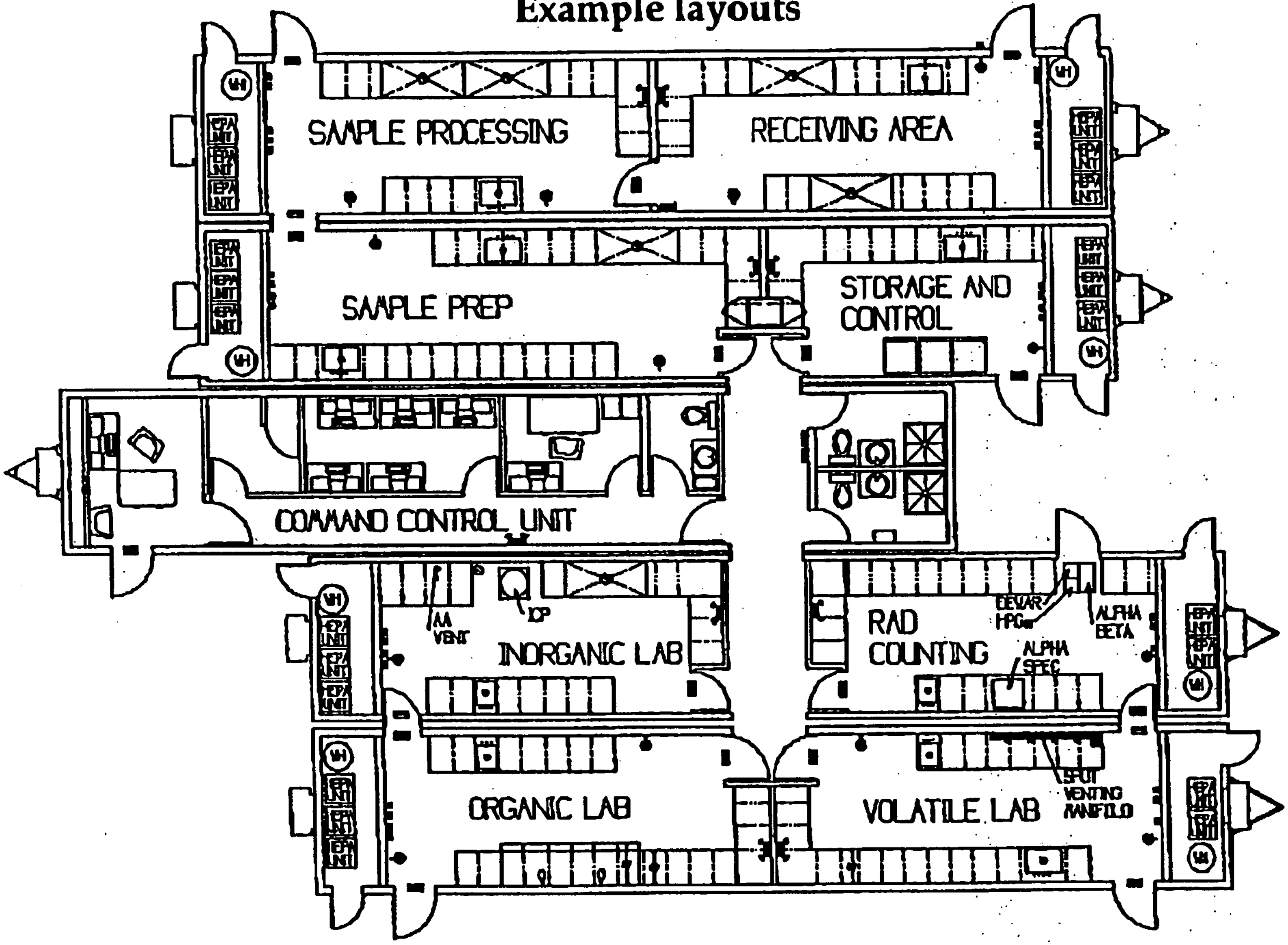


Designed to support DOE operations at INEL Pit #9

NFSystems

NFS RPS Modular Laboratory System

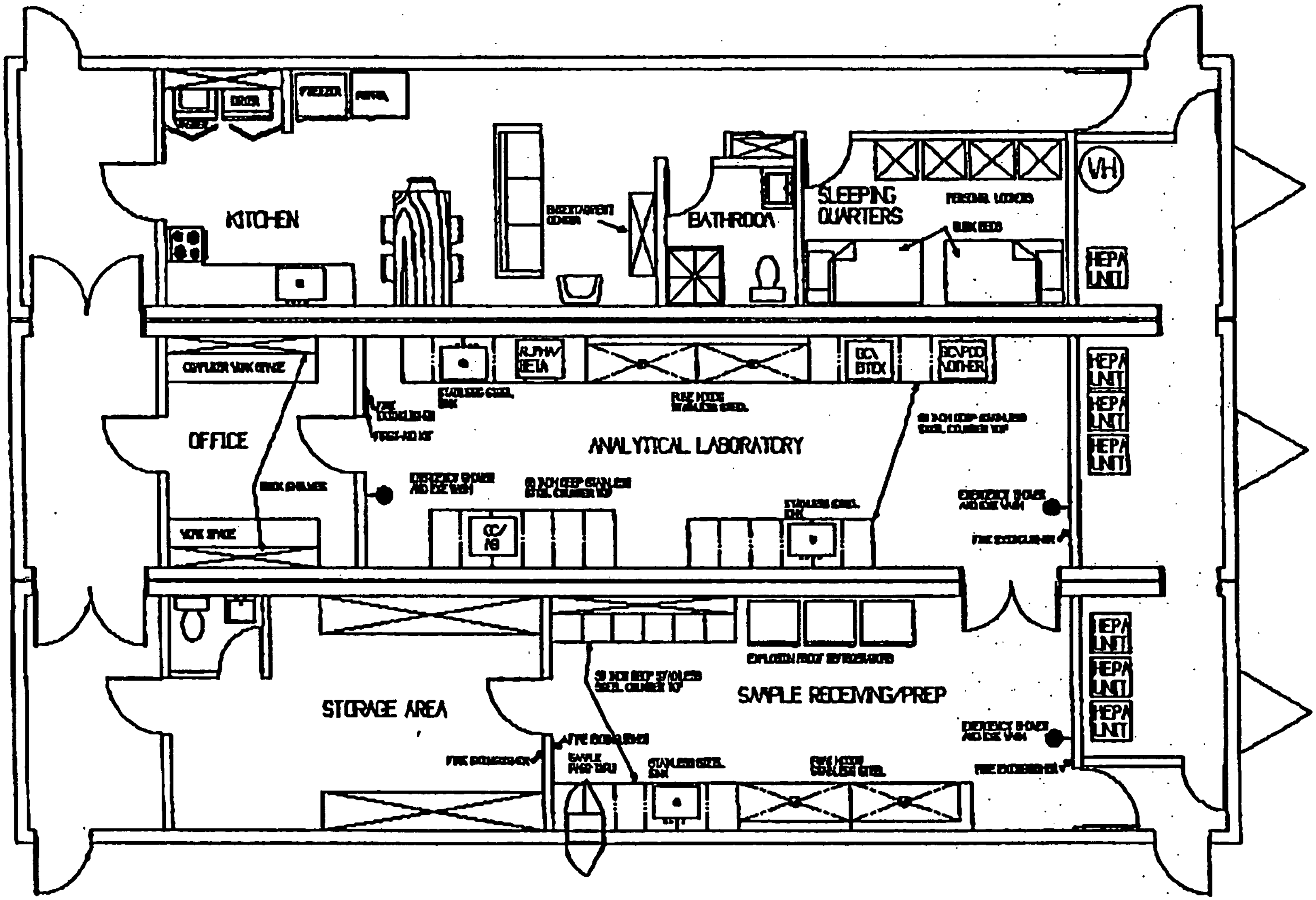
Example layouts



Designed to support DOE operations at Nevada Test Site

Modular Laboratory System

Example layouts



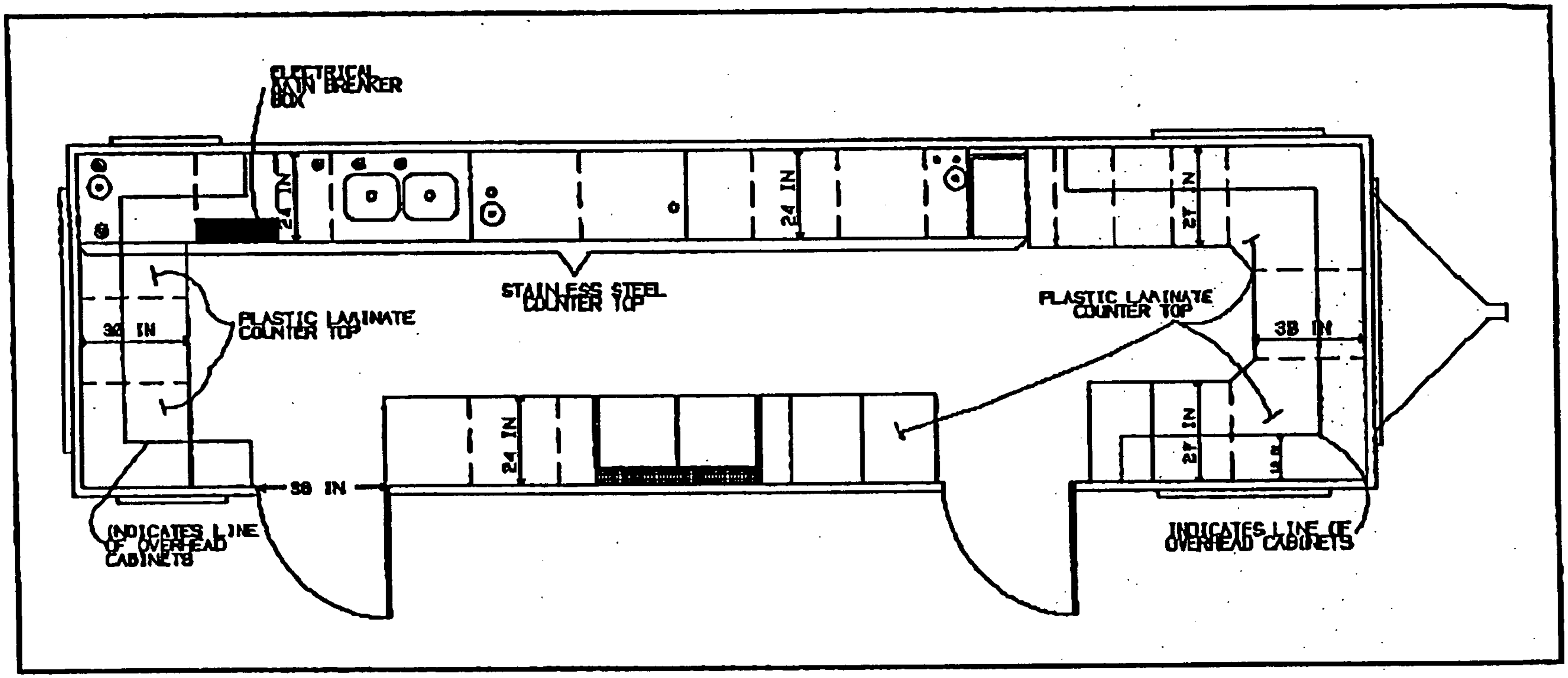
Designed for Argonne National Engineering Labs to support remedial activities in the Antarctic

NFSystems

NFSRPS Modular Laboratory System

EPA CSL 3008
REM II, IV and
ARCS Programs

Example layouts



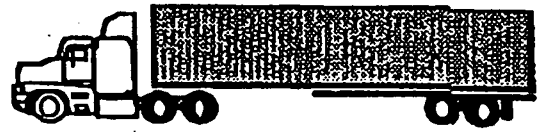
Designed and built for U.S. EPA REM/FIT and ARCS program

EcoTek LSI

NESystems

NESRPS
Modular Laboratory System

Available Mobile Products



- Access Control Stations (ACS)
  - ACS2080 -- 20 ft. towed
- Close Support Lab (CSL)
  - CSL2608 -- 26 ft. towed
  - CSL3008 -- 30 ft. towed
  - CSL3508 -- 35 ft. towed
  - CSL4508 -- 45 ft. 5th wheel
- Decontamination/Change House Facility (DCF)
  - DCF3008 -- 30 ft. towed
  - DCF4812 -- 48 ft. relocatable
  - DCF6614 -- 66 ft. relocatable
- Mobile Communications/Command Center (MCC)
  - MCC2008 -- 20 ft. self-propelled
  - MCC3008 -- 30 ft. self-propelled
  - MCC4008 -- 40 ft. self-propelled
- Waste Stabilization
- Respiratory Cleaning
- Mobile Information System (MIS)
  - MIS3008 -- 30 ft. towed
- Mobile Power System (MPS)
  - MPS4708 -- 47 ft. relocatable
- Modular Support System (MSS)
  - MSS4010 -- 40 ft. relocatable
  - MSS4812 -- 48 ft. relocatable
  - MSS6012 -- 60 ft. relocatable
- Mobile Warehouse Facility
  - MWF2008 -- 20 ft. towed
- PCS -- Portable Communications System
- Radiation Lab Facility (RLF)
  - RLF4010 -- 40 ft. relocatable
- Self Propelled Laboratory (SPL)
  - SPL3008 -- 30 ft. fully self-contained lab
  - SPL4008 -- 48 ft. fully self-contained lab

TOWED: Means towable by 3/4 ton pick-up, van or suburban
RELOCATABLE: Towable by tractor (i.e., mobile home mover)
SELF-PROPELLED: Highly mobile, operates all systems under resident power

NFSystems

Modular Laboratory System

CSL-3008 Historical
CH2M-Hill Montgomery, AL
REM IV Program

Analytical Performance Specifications

- Has Supported:
  - 3 analysts per shift
  - 24 hour/day sustained
  - Operations 1 day to 2 plus years
- Functionality:
  - Atomic absorption spectrophotometer
  - Gas chromatography
  - Mass spectrometry
  - Ultra violet/visible spectrometry
  - Total organic carbon analyzer
  - Purgeable organic halide analyzer
  - High pressure liquid chromatography
  - Ion chromatography
  - Sohxlet extraction apparatus
  - Sonification extraction equipment
  - Grinders/mills/sieves
  - EP TOX/TCLP Extractors
  - Alpha, Gross Beta Gamma
  - Bench Scale Treatability Equipment
- Production Examples (per shift) (historical):
  - 30 PCB Samples/Day
  - 45 Metals (3 elements)/Day by Flame AA
  - 20 PNA Samples/Day
  - 20 VOC (8010/8020 List) Samples/Day
  - 30 VOC (5 Target VOC) Samples/Day

NFESystems

NFESRPS
Modular Laboratory System

A number of options may be added to achieve the *ultimate integrated system:*

- Data processing and record management system
  - Critical to sample tracking, sample scheduling and a key element to QA/QC
- Data validation menu preprocessor
  - A complex data base used for measuring and testing equipment performance
- On-line system
  - Identifies the use of data in accordance with the functional guidelines for organic, inorganic, and radiological analyses
- Data reduction system
  - A direct feed of data base information for the programmed reduction of data
- Site conceptual modeling
  - Using a three dimensional system, data generated can provide information to the site manager for real time assessment
- Risk assessment
  - Analysis for the revision of baseline risk assessment, cross-medial contamination assessment and remedial technologies screening

Certain criteria should be considered when integrating a CSL into existing analytical programs or work plan development. . .

- The first step in evaluating the feasibility of a CSL for a given project is development of project-specific data quality objectives
  - Based on the DQOs developed for a site, the CSL may offer the most beneficial and/or most cost-effective means of analysis
- The criteria might include:
  - Data usage
    - Litigation, remediation, risk assessment, treatability, performance assessments
  - Analytical needs
    - Types and variety of tests, numbers of samples
  - Other analytical procedures to achieve the project needs
  - Cost-effectiveness
  - Quality Assurance Objectives
    - Detection limits, precision, and accuracy
  - Data turnaround requirements
    - Immediate, same day, same work period, or not immediate
  - Sample load requirements
  - Other logistical considerations
    - Project control, data feedback, maximizing field activities

There are many sound technical and budgetary benefits associated with using a CLOSE SUPPORT LABORATORY (CSL) . . .

- Provides timely data to project staff when most pertinent to ongoing activities
- Permits project management to make informed decisions concerning work direction and helps identify needed adjustments
- Reduces the tendency to under- or over-investigate a site
- Allows focusing on proper target parameters
- Permits the use of customized methods to best analyze the required site parameters
- Provides additional data sets for use in feasibility studies
- Offers a cost-effective alternative to extensive offsite laboratory analytical work
- Eliminates sample packaging and shipping costs
- Provides data in near real time

NFSystems

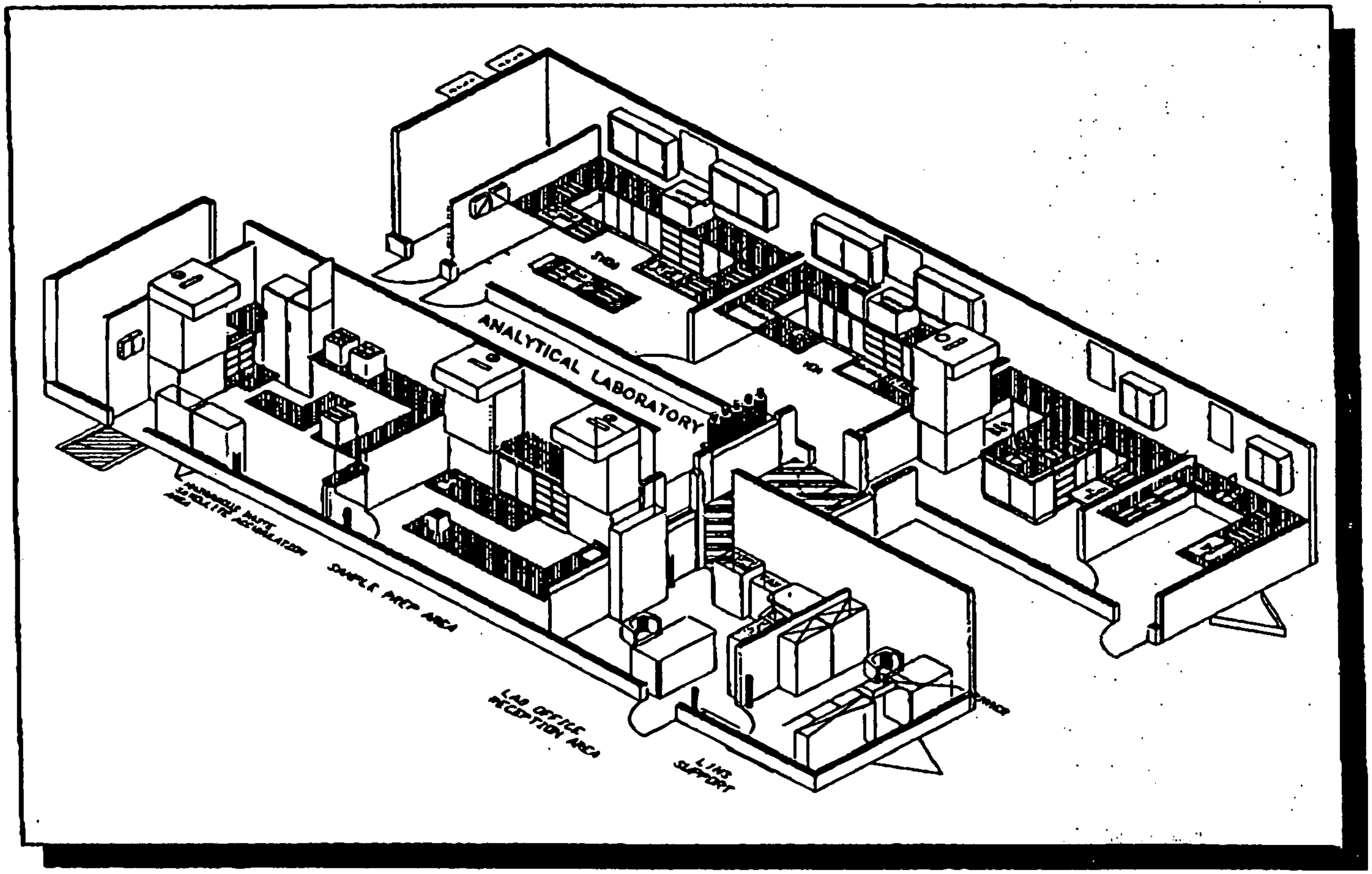
NFSRPS
Modular Laboratory System

Performance of complex laboratory analyses *onsite* is an extremely useful tool. . .

- A MODULAR LABORATORY SYSTEM (MLS) provides design, construction, equipment, and operation of a relocatable facility
- Key design considerations include:
  - Receiving and storing numerous samples of mixed wastes
  - Providing a command and control center that fully integrates information into a reduced data package
  - Maintaining QA/QC integrity and QA secured operations during implementation of:
    - Sample control/chain of custody
    - Sample preparation
    - Organic analyses
    - Volatile organic analyses
    - Inorganic analyses
    - Low level radiological analyses
  - Providing facilities integrated data processing/data management system which can include:
    - Data validation system
    - Data reduction system
    - Risk assessment/risk management system
    - Site conceptual modeling

Attachment 3
SF307: 01 94:01
Page 16 of 17

The Modular Laboratory System Concept



NFSystems

NFS RPS
Modular Laboratory System

CONTAMINANTS OF CONCERN

METALS

Barium
Beryllium
Cadmium
Chromium (VI)
Mercury
Nickel

RADIONUCLIDES

Americium-241
Plutonium-239/240
Tritium
Uranium-235

SEMI-VOLATILE ORGANICS

1,4-dichlorobenzene
2,6-dinitrotoluene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Bis(2-ethylhexyl)phthalate
Chrysene
Hexachlorobenzene
Indeno(1,2,3-cd)pyrene
N-nitrosodipropylamine
Pentachlorophenol

PESTICIDES

Archlor-1254

ORGANICS

1,1,1-trichloroethane
2-hexanone
Phenanthrene
1,2-dichloropropane
1,4-dichlorobenzene
Chloroethane

DRAFT ANNOTATED OUTLINE
POST-CLOSURE MONITORING AND ASSESSMENT PLAN
SOLAR EVAPORATION PONDS, OPERABLE UNIT 4
ROCKY FLATS PLANT, GOLDEN, COLORADO

January 17, 1994

DRAFT

DRAFT ANNOTATED OUTLINE
POST-CLOSURE MONITORING AND ASSESSMENT PLAN
SOLAR EVAPORATION PONDS, OPERABLE UNIT 4
ROCKY FLATS PLANT, GOLDEN, COLORADO

January 17, 1994

V.1 INTRODUCTION

V.1.1 PURPOSE AND OBJECTIVES

This plan describes the post-closure monitoring plan for Operable Unit 4 (OU4) at the Rocky Flats Plant. The monitoring plan will satisfy applicable regulations (to be cited). The intent of these regulations, as applied to this site will be described.

There will be three monitoring systems with associated monitoring programs. The engineered barrier/cover (cover) monitoring system will be capable of measuring a loss of integrity of the remedial cover and provide early warning of the potential for water movement into the waste. The vadose zone monitoring system will monitor for movement of liquids through the vadose zone and provide early warning of the potential for contaminant migration to groundwater. The groundwater monitoring system will detect releases from beneath the cover and the vadose zone to the groundwater. The groundwater system will provide an early warning system to downgradient receptors.

V.1.2 ORGANIZATION OF PLAN

The organization of this plan will be described. Regulatory references will be cited as appropriate.

Sections in the plan present the technical basis for the monitoring systems and implementation information. The design basis for the monitoring systems will be developed, appropriate technology selected, and an integrated conceptual design prepared. Monitoring protocols specific to the monitoring systems will be presented. Responses to monitoring system alarms will also be presented. Following these technical sections, an Implementation Plan, a cost estimate, and a construction schedule will be included.

V.1.3 INTEGRATION WITH THE PHASE 2 RFI/RI

The Phase 2 RFI/RI will investigate potential impacts to groundwater at OU4. A significant opportunity exists to combine and integrate the groundwater monitoring efforts of the Phase 2 RFI/RI with the OU4 post-closure monitoring and maintenance plan. The plan will be integrated to the greatest extent possible and practical with the Phase 2 RFI/RI such that the data collected for each program complements but does not duplicate or compromise the other. An example would be the coordination of sampling events to prevent collection of redundant data.

V.2 DESIGN BASIS

Basis for the design of the post closure monitoring systems includes the regulatory requirements, satisfaction of certain performance criteria, and the ability to integrate the design with the cover design.

V.2.1 REGULATORY FRAMEWORK

A detailed listing of regulations pertinent to each monitoring system is included. The rationale for including or excluding various types or classes of regulations is provided. Regulations guiding the monitoring systems for the cover and vadose zone are not yet promulgated, but draft regulations are available. The groundwater monitoring system will comply with applicable or relevant and appropriate hazardous waste and low-level radioactive waste requirements.

V.2.1.1 Engineered Barrier/Cover System

Cover systems are an essential part of all land disposal facilities. Covers control moisture infiltration from the surface into closed facilities and limit the formation of leachate and its migration to groundwater. RCRA subparts G, K, and N form the basic requirements for cover systems being designed and constructed today. CERCLA refers to RCRA Subtitle C regulations, and the state of Colorado has its own requirements. Under RCRA, significant consideration must be given to the nature and extent of post-closure monitoring that will be required as the result of the closure process. A discussion of the regulations which address monitoring procedures and acceptance criteria will be provided.

V.2.1.2 Vadose Zone System

Federally mandated requirements for vadose zone monitoring for hazardous waste land treatment units permitted under RCRA, Subtitle C will be discussed as well as the published EPA guidance for implementing it. This guidance is the precursor to regulations currently in draft stage which will provide for vadose zone monitoring of RCRA, Subtitle C facilities. EPA recently proposed to amend federal regulations to require vadose zone monitoring at hazardous waste facilities. The draft regulations will be discussed in general to provide an understanding of requirements which will have to be met in the near future. The forthcoming guidance recommends the use of both direct and indirect monitoring technologies which can effectively detect contamination that may leak from hazardous waste facilities into the vadose zone and ultimately impact groundwater. Discussion will be given as to EPA's view of this approach not only in terms of providing a technical advantage in preventing facility impacts to groundwater, but also in terms of reducing the scope of saturated zone monitoring required under the appropriate conditions.

V.2.1.3 Groundwater System

Groundwater monitoring programs for interim status land units such as OU4 are regulated under 40 CFR (RCRA) Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities. Statistical Analyses of groundwater quality data is regulated by the EPA guidance documents "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (February 1989). Applicable Colorado regulations will be cited.

V.2.2 PERFORMANCE CRITERIA

Performance criteria will be used to evaluate technologies which may potentially be used in the three monitoring systems. A set of performance criteria have been developed (Geraghty

& Miller and ERM, 1994 and 1994b). The performance criteria will be used to evaluate the anticipated performance of each technology at OU4 and to screen out technologies that do not meet the performance criteria or that are clearly inappropriate for use at this site. Technologies that are not expected to perform at or above these levels will not be considered further.

The performance criteria (ERM and Geraghty & Miller, 1994a and 19946) were developed to establish the minimum level of performance for the post-closure monitoring and maintenance system. Because the purpose and methods of vadose zone monitoring versus groundwater monitoring are very different (vadose zone monitoring is proactive, whereas groundwater monitoring is reactive), the performance criteria for the cover system and the vadose zone system will differ from the groundwater monitoring system.

V.2.2.1 Engineered Barrier/Cover System

The cover monitoring system must be able to reliably provide high quality, precise data. Data generation and collection must be automated. Data sampling must occur at an interval adequate to provide early warning of potential liquid movement through the cover system, and be useful in identifying seasonal and long-term trends in data values. The generated data must provide areal coverage adequate to identify conditions conducive to migration of liquid throughout the entire cover system.

V.2.2.2 Vadose Zone System

The vadose zone monitoring system must be able to reliably provide high quality, precise data. Data generation and collection must be automated. Data sampling must occur at intervals adequate to provide early warning of a release or liquid movement, and to be useful in identifying seasonal and long-term trends in data values. The generated data must provide areal coverage adequate to identify production and migration of leachate and water out of the cover system.

V.2.2.3 Groundwater System

The groundwater monitoring system will consist of groundwater monitoring wells. The wells must be constructed in accordance with the Technical Guidance for Groundwater Monitoring (U.S. Environmental Protection Agency. November, 1992). To the greatest extent practical, the groundwater monitoring system will be integrated with the Phase 2 RFI/RI. The performance criteria for the groundwater monitoring system are described in "Proposed Performance Criteria for the Groundwater Monitoring System for the Interim Measure/Interim Remedial Action, Operable Unit 4, Rocky Flats Plant, Golden, Colorado" (Geraghty & Miller and ERM, 1994b).

V.2.3 INTEGRATION OF MONITORING SYSTEMS WITH THE COVER DESIGN

The layout and construction of the monitoring systems must not compromise the integrity or performance of the selected remedial alternative. The three monitoring systems will provide an integrated evaluation of the performance of the remedial cover.

V.3 TECHNOLOGY EVALUATION AND SELECTION

Potentially applicable monitoring technology will be described. Technology that work best when used in concert will be identified. These technologies will then be evaluated relative to the performance criteria described in Section 2. This evaluation will not necessarily determine the exact equipment to be used for monitoring, but it will screen out those technologies that are not likely to perform at or above the criteria and ensure that the selected technologies are appropriate for this site and application. The evaluation of the various technologies will then be compared to identify the most appropriate monitoring technologies.

V.3.1 TECHNOLOGY EVALUATION AND SELECTION METHODOLOGY

A discussion of the technology evaluation and selection methodology will be presented in the section. This methodology will be based on an evaluation of each technology with respect to the performance criteria presented in Section 2.2. Those technologies that are incapable of meeting the performance criteria will not be retained for further evaluation. No technology will be eliminated from the evaluation process without justification. Those technologies that initially seem able to satisfy the performance criteria will be retained for further, more detailed analysis to select the optimum monitoring technologies. This methodology will be documented, supported, and justified.

V.3.2 IDENTIFICATION AND SCREENING OF MONITORING TECHNOLOGIES

This section will include a description of the principle of operation, data collection method, parameters measured, a statement of precision, bias, and accuracy (where applicable), materials of construction, power requirements, advantages of the method, limitations of the method, potential signal interferences, and installation methodologies for all relevant monitoring technologies. The descriptions will be provided for each of the three monitoring systems and will be presented as matrices for ease of presentation and reading. In addition to the matrices, a short narrative will be included to introduce the separate systems sections, describe the overall organization, and to elaborate on methodology descriptions where necessary.

V.3.3 DEVELOPMENT AND SCREENING OF MONITORING ALTERNATIVES

Potential monitoring technologies will be evaluated with respect to the performance criteria described in section 2.2. A relative scoring scheme will be established such that the highest scores will be given to technologies which are most applicable to the site and remedial design and the lowest scores will be given to technologies which are less applicable to the site and remedial design. Categories in which the equipment will be evaluated include reliability, precision, automatic data acquisition and multiplexing capabilities, site signal attenuation factors, depth of measurement capabilities, ease and cost of installation, cost of sampling and/or measurement, operations and maintenance requirements, compatibility of the instrument materials of construction with respect to site hydrogeology and the anticipated 30 year life of the monitoring system, and compatibility with the selected remedial design with respect to installation and vertical penetration of the cover system. Evaluation of the technologies will be presented in the form of matrices which summarize the evaluation process. Additional narrative will be provided to elaborate on the advantages and limitations of each specific technology with respect to application at the site.

V.3.4 DETAILED ANALYSIS AND COMPARISON OF MONITORING ALTERNATIVES

Based on evaluation of monitoring technologies as described in section 3.3 above, equipment and instrumentatio which are likely candidates for use in monitoring the performance of the remedial design will be identified. Final selection of the monitoring instrumentation to be used at the site will be closely related to the final, detailed design of the remedial action and cover system. Identification of the selected monitoring technologies in this step will provide the basis for preliminary conceptual design of the monitoring system. Final selection of the appropriate monitoring technologies will be revised and finalized based on the final design of the remedial action.

V.4 CONCEPTUAL DESIGN OF MONITORING SYSTEM

At least three conceptual monitoring system designs will be developed incorporating the selected technologies. The conceptual designs will specify technologies (as determined in Section 3.0), integrate the technologies into systems, identify information and control principles, and provide the general layout of the monitoring systems at the site. The layout of the system will provide for adequate spatial coverage of the area as well as provide upgradient and downgradient groundwater coverage.

V.4.1 ENGINEERED BARRIER/COVER SYSTEM

The focus of the monitoring system in the cover will be to identify and provide early warning of hydrologic conditions conducive to movement of soil water through the cover and into the underlying waste pile. Technologies selected in section 3.4 above will be incorporated into the monitoring system design. The goal of the system will be to monitor hydrologic factors which will control the water balance in the cover. Such factors include climatic data which affect evapotranspiration, climatic factors which affect infiltration into the cover, and the status of soil moisture content in the cover itself. A discussion will also be presented on the techniques required to successfully install the monitoring system and how it will be incorporated into the design of the selected remedial alternative. Final design of the cover monitoring system will be revised and finalized based on the final design of the selected remedial alternative.

V.4.1.1 Integration of the Cover Monitoring System

The monitoring system installed in the cover system can be designed and installed at less cost and operate more efficiently if integrated into the cover design from the initial design phase. This section will include a discussion of the procedures required to integrate construction of the cover monitoring system with construction of the cover system. These requirements include, but are not limited to, construction techniques, distribution and depth of placement of monitoring devices in the cover system, and the location, access, and power requirements of the data collection points. Discussion will also be given as to the method of installation and location of the monitoring devices such that penetration of the cover is minimized and that the performance of the cover is not compromised.

V.4.2 VADOSE ZONE SYSTEM

The focus of the vadose zone monitoring system is to identify and provide early warning of conditions conducive to subsurface water or leachate movement into or out of the waste pile from any direction with special emphasis on providing early warning of conditions conducive to contaminant migration to the underlying saturated zone. Technologies selected in section 3.4 above will be incorporated into the monitoring system design. In addition to a discussion of the spatial layout of instrumentation which will provide this warning, a discussion will be provided as to the layout of an instrumentation network which will be used to sample vadose zone pore liquids. It is important to note that the design will be formulated such that early warning of conditions which present the potential for contaminant migration to groundwater will be given. The design will incorporate cost-effective indirect techniques which will measure parameters indicative of the potential for contaminant flow and migration, as well as direct sampling techniques which will yield direct analytical results indicative of the status of mobile contaminants in the vadose zone. A discussion will also be presented on the techniques required to successfully install the monitoring system and how it will be incorporated into implementation of the design of the selected remedial alternative. Final design of the vadose zone monitoring system will be revised and finalized based on the final design of the selected remedial alternative.

V.4.2.1 Integration of the Vadose Zone Monitoring System

The monitoring system installed in the vadose zone beneath the engineered barrier/cover system can be designed and installed at less cost and operate more efficiently if integrated into the cover design and installation from the initial design phases. Discussion in this section will cover the distribution and depth of placement of monitoring devices in the vadose zone as well as the location, required access, and power requirements of data collection points. Discussion will also be given as to the method of location and installation of the vadose zone monitoring devices such that penetration of the cover is minimized and that the performance of the cover is not compromised. Rationale for the location of lateral vadose zone monitoring installations will also be discussed as well as integrating their installation with the cover system.

V.4.3 GROUNDWATER SYSTEM

This section will present the conceptual design of the groundwater monitoring system. The monitoring system will consist of groundwater wells installed upgradient and downgradient of the closed waste pile. The locations and quantity of downgradient wells will be selected to detect potential impacts to groundwater from OU4 at the earliest practicable time and to permit statistical analysis of groundwater data such that variations in groundwater quality can be correctly interpreted. The locations and quantity of upgradient wells is of equal importance. A sufficient number of upgradient wells must be installed and carefully located in order to develop a statistically valid representation of upgradient groundwater quality.

V.4.3.1 Integration of the Groundwater Monitoring System

A discussion of the measures required to integrate the groundwater monitoring system with construction of the cover system will be discussed in this section. It is anticipated that the cover system will encompass the majority of OU4. Many existing groundwater monitoring wells will therefore require abandonment. Installation of groundwater monitoring wells which penetrate the cover system may jeopardize the integrity of the cover and/or the projected 1,000 year design lifetime of the cover. Methods, locations, and materials of construction which do not compromise the integrity of the cover will be discussed.

V.5 MONITORING SYSTEM DESCRIPTION

The monitoring system description, protocols will satisfy all regulatory requirements. Sufficient detail is provided in each subsection to allow completion of the required tasks.

V.5.1 ENGINEERED BARRIER/COVER SYSTEM

V.5.1.1 System Layout

Description of the location and depths of monitoring system components.

V.5.1.2 Measurement Procedures

Indirect monitoring techniques will likely be used to measure factors affecting the water balance in the cover to identify and provide early warning of conditions conducive to the potential movement of water through the cover into the underlying waste pile. No direct sampling is likely to be needed in the cover system. Standard operating procedures (SOPs) will be developed in a format acceptable for use at the Rocky Flats Plant. Where appropriate, existing Rocky Flats SOPs will be utilized which provide detailed protocols for implementation of the selected monitoring technologies identified in Section 3.4.

V.5.1.3 Frequency of Measurement

This section will describe the frequency of measurement needed to identify hydrologic events which may cause conditions conducive to the potential movement of water through the cover into the underlying waste pile. The section will provide discussion which examines the available historical record of climatic conditions for the Rocky Flats Plant as the basis for development of a rationale upon which the frequency of measurement events will be based. Additionally, climatic events will be prescribed which, when observed to occur, will trigger a monitoring event, where appropriate. In this way, measurement of factors affecting the water balance in the cover can be correlated with climatic events in order to monitor the hydrologic dynamics of the selected remedial design.

V.5.1.4 Statistical Evaluation

Guidance for the statistical evaluation of groundwater monitoring data at RCRA facilities has been promulgated by the EPA (1989). Where appropriate and applicable, this same guidance will be applied to monitoring data collected in the cover system. One method of statistical analysis may not be appropriate for the entire life of the monitoring system. For example, at the beginning of the post-closure period only limited monitoring data will be available and some form of hypothesis testing may be appropriate such as parametric analysis of variance. However, once sufficient data becomes available, another method of analysis such as control charting may be more appropriate. Each method of analysis and the conditions under which they will be used will be discussed.

V.5.1.5 Threshold Values

The concept of threshold values will be implemented as a part of the post closure monitoring and assessment plan. Threshold values are those measurement values above which a warning is triggered that indicates that conditions conducive to the potential mobilization of contaminants in the subsurface are present. Specific procedures for determining threshold values will be identified for the cover in this section.

V.5.1.6 Ambient Monitoring Data

Other data collected as a part of the monitoring system will not be subject to threshold test, but are necessary to collect in order to facilitate macroscopic interpretation of data collected to measure performance of the remedial design. An example of such data is temperature data collected in the cover system profile to describe the propagation of freezing and thawing fronts in order to determine the potential for piston flow of wetting fronts during spring thaw conditions.

V.5.2 VADOSE ZONE SYSTEM

V.5.2.1 System Layout

Description of the location and depths of monitoring system components.

V.5.2.2 Measurement Procedures

Both indirect and direct sampling techniques will be utilized in the vadose zone system. Indirect monitoring techniques will likely be used to measure factors affecting the potential for migration of water into the waste from subsurface sources and to identify and provide early warning of conditions conducive to the potential movement of leachate in the vadose zone which could represent a potential impact to groundwater.

Where appropriate, existing Rocky Flats standard operating procedures (SOPs) will be utilized which provide detailed protocols for implementation of the selected monitoring technologies identified in section 3.4. Direct monitoring will be conducted as diagnostic evidence of the status of contaminants which could potentially migrate in the vadose zone. Sample collection and handling will be described. Sampling and handling procedures for direct pore liquid samples will be in accordance with regulations governing the handling of groundwater samples taken from the saturated zone. Sampling and handling will be conducted in a manner which provides for the protection of the public and sampling and laboratory personnel. Proper and consistent sample handling will ensure high quality data that can be retained and used over time. Procedures to measure field parameters during sample collection will also be described. Sampling protocols applicable to sampling groundwater from the saturated zone will be modified as necessary and described to accommodate the unique requirements of pore liquid sampling from the vadose zone.

V.5.2.3 Frequency of Measurement

This section will describe the frequency of measurement needed to identify hydrologic conditions conducive to the potential movement of subsurface water into the waste and hydrologic conditions conducive to movement of subsurface vadose zone water into the underlying groundwater. The section will provide discussion which examines the available historical record and data collected during the OU4 RFI as the basis for development of a rationale upon which the frequency of measurement events will be based. Also to be considered will be the regulated requirement of the frequency of sampling the underlying groundwater.

Direct sampling event frequencies will be described that are sufficient to satisfy appropriate regulations, develop a statistically valid database, and provide early warning in the event of a release of constituents of concern from OU4. Sampling events will also be of a frequency sufficient to describe pore liquid across the four seasons. A description will also be given of pore liquid sampling events that are triggered by the analysis of data resulting from measurement of the hydrologic parameters used to indicate the potential for migration of contaminants in the vadose zone. For example, if vadose zone hydrologic measurements indicate that subsurface hydrologic conditions have changed such that the probability for aqueous migration of contaminants is significantly increased, an unscheduled pore liquid sampling event may be triggered.

V.5.2.4 Analytical Parameters and Procedures

Analytical parameters and the corresponding analytical procedures will be identified. There are two classes of groundwater analytical parameters. These are groundwater quality relative to drinking water and the identified constituents of concern.

V.5.2.5 Statistical Evaluation

Guidance for the statistical evaluation of groundwater monitoring data at RCRA facilities has been promulgated by the EPA (1989). Where appropriate and applicable, this same guidance will be applied to monitoring data collected in the vadose zone. One method of statistical analysis may not be appropriate for the entire life of the monitoring system. For example, at the beginning of the post-closure period, only limited monitoring data will be

V.5.3.2.4 Water Level Measurement

V.5.3.3 Frequency of Measurement

The frequency of sample collection must be sufficient to satisfy appropriate regulations, develop a statistically valid database, and provide early warning in the event of release of constituents of concern from Operable Unit 4.

V.5.3.4 Analytical Parameters and Procedures

Analytical parameters and the corresponding analytical procedures will be identified. There are two classes of groundwater analytical parameters, groundwater quality relative to drinking water and the identified constituents of concern.

V.5.3.5 Statistical Evaluation

One or more statistical evaluation methods will be identified. The data will be evaluated to compare upgradient and downgradient chemical concentrations and field parameters. Variations within each monitoring well over time will also be evaluated.

V.5.3.6 Threshold Values

Threshold values are statistically significant variations from existing baseline chemical concentrations and field parameters. Data that are beyond threshold values will trigger response actions (Section 6). Procedures for determining threshold values will be determined.

V.5.4 BACKGROUND DATA

Discussion of consitituents upgradient of OU4. Upgradient monitoring systems, primarily groundwater will be critical for the determination of relative contribution of various constituents to groundwater load.

available and some form of hypothesis testing may be appropriate such as parametric analysis of variance. However, once sufficient data becomes available, another method of analysis such as control charting may be more appropriate. Each method of analysis and the conditions under which they will be used will be discussed. Direct pore liquid sampling data will be evaluated to compare chemical concentrations and parameters between offsite background conditions to the "active" vadose zone beneath the waste. Variations within each monitoring point over time will also be evaluated.

V.5.2.6 Threshold Values

The concept of threshold values will be implemented as a part of the post closure monitoring plan. Threshold values are those measurement values above which a warning is triggered that indicates that conditions conducive to the potential mobilization of contaminants in the subsurface is present. Exceedance of pore liquid threshold values will be described in terms of background comparison with the active zone until sufficient data is collected over time to justify intrapoint comparisons. Once that justification can be made, threshold values will be developed which are based on intrapoint comparisons.

V.5.3 GROUNDWATER SYSTEM

V.5.3.1 System Layout

Description of the location and depths of monitoring system components.

V.5.3.2 Measurement Procedures

V.5.3.2.1 Sample Collection and Handling

Sample collection and handling will be described. Sampling and handling procedures will be in accordance with appropriate regulations and provide for the protection of the public and sampling and laboratory personnel. Proper and consistent sample handling will ensure high quality data that can be retained and used over time. Procedures to measure field parameters during sample collection will also be described.

V.5.3.2.2 Shipping Methodologies

V.5.3.2.3 Additional Parameters

V.6 DATA QUALITY OBJECTIVES

This section will provide a discussion of the procedures required to ensure that monitoring data is of a consistent high quality. All data collected will be validated to ensure that comparable and precise data are used to monitor the post-closure performance of the cover. Data quality is defined as conformance to properly developed requirements. Data are expected to be representative, comparable, precise, and accurate through an adherence to the properly developed quality assurance (QA) procedures and quality control (QC) systems.

Data are representative to the extent that the design of monitoring systems are representative. Considerations in evaluating the representativeness of the data include, but are not limited to, the proper selection of sample locations, the methods used to obtain environmental samples at the site, and the appropriateness of the analytical method for the type of sample obtained.

Precision and accuracy are also part of laboratory procedures. Laboratory QA techniques for the analysis of environmental samples have become standardized, and many of the currently accepted techniques are outlined in Test Methods for Evaluating Solid Waste, SW-846 (USEPA 1982). For non-SW-846 methodology, Standard Methods for Evaluation of Water and reference Wastewater will provide standardization. These methods together with the specific Quality Assurance Program Plans (QAPP) ensure that laboratory procedures are accurate and precise.

The components of the data validation program will be presented. It is expected that at least 85 percent of the data will be validated as quantitative (completely usable for technical conclusions) or qualitative (usable for some technical conclusions, though not necessarily for statistics). Laboratory QC systems will also be presented.

V.7 RESPONSE ACTIONS

Response actions are activities that occur should threshold values be detected during the monitoring program. Response actions range from verification of threshold values to mitigation of leachate or contaminant migration. All response actions are oriented to prevent movement of the constituents of concern beyond the limits of OU4.

V.7.1 ENGINEERED BARRIER/COVER SYSTEM

Data will be collected from the cover system for the primary purpose of identifying and providing early warning of conditions conducive to the potential movement of water through the cover into the underlying waste. Once these conditions are identified, a response action may be required. Discussion will be given in this section as to the appropriate response actions to be taken for an identified "early warning" condition. Appropriate response actions to an early warning provided by the cover monitoring system may include such actions as confirmatory measurement, cover inspection, and various forms of cover modification.

V.7.2 VADOSE ZONE SYSTEM

Data will be collected from the vadose zone for the primary purpose of identifying and providing early warning of conditions affecting the potential for migration of water into the waste from subsurface sources and to identify and provide early warning of conditions conducive to the potential movement of leachate from the waste which could represent a potential impact to groundwater. Once these conditions are identified, a response action may be required. Discussion will be given in this section as to the appropriate response actions to be taken for an identified "early warning" condition. Appropriate response actions to an early warning provided by the vadose zone monitoring system may include such actions as confirmatory measurement, unscheduled diagnostic pore liquid sampling, unscheduled groundwater sampling, cover inspection and maintenance and repair if necessary, cover modification (such as at the apron of the cover), and/or dewatering of saturated zones.

V.7.3 GROUNDWATER SYSTEM

Groundwater data will be collected for the primary purpose of identifying and providing early monitoring of impacts to groundwater. Once these conditions are identified, a response action may be required. This section will identify appropriate response actions to be taken if these conditions are identified. Actions may include statistical analysis, resampling and analysis for additional constituents or sampling of additional wells.

V.8 IMPLEMENTATION PLAN

The Implementation Plan describes the design and construction process of the monitoring systems. Construction of these systems will be coordinated and integrated with the construction of the remedial cover. A number of deliverables, such as specifications, plans, and Operation and Maintenance Manual, are listed in the Implementation Plan. Quality control/quality assurance requirements during construction are described.

V.9 PERFORMANCE ASSESSMENT

Performance assessments of all 3 monitoring systems will be required at 5-years and 30-years of operation. The performance assessments will evaluate the performance of the systems over the period of study. This section will discuss the contents and the criteria to be evaluated by the performance assessments.

V.9.1 REDUCTION IN MONITORING

Development of the monitoring plan is based on the assumption that the selected remedial alternative will incorporate a 1,000 year design life. Monitoring and maintenance of the remedial action, in accordance with RCRA, incorporates a period of 30 years. It is anticipated that initial monitoring of the site will be most intensive at the beginning of the facility life and can be reduced in part or whole in later stages of the design life. This section will be used to describe the criteria which will be developed in order to determine the appropriate time and conditions under which the scope of monitoring at the facility can be reduced in whole or part.

V.9.1.1 Engineered Barrier/Cover System

Monitoring of the engineered barrier/cover system will likely consist of measurement of climatic and cover hydrologic parameters. Criteria will be developed to identify conditions under which monitoring can be reduced or eliminated in the cover system. Monitoring reduction may be possible in either space or time.

V.9.1.2 Vadose Zone System

This section will be used to develop and discuss criteria that will be use to identify conditions under which monitoring can be reduced or eliminated in the vadose zone.

V.9.1.3 Groundwater System

This section will develop and discuss criteria that will be used to identify conditions under which monitoring can be reduced or eliminated for the groundwater system.

V.10 SYSTEM ABANDONMENT AND DISPOSITION PLAN

It is currently anticipated that the post-closure monitoring systems will be operated for a period of 30 years. At the end of the 30-year post-closure monitoring period or an alternate period specified by the regulatory agency, the systems will require abandonment and demolition. This section will discuss the schedule and procedures for abandoning and disposing of the monitoring systems. Could monitor less often or have continuous monitoring. Abandonment will be based on the results of the performance assessment.

V.11 REFERENCES

Durant, Neal D., V.B. Myers, and L.A. Eccles., 1993. EPA's Approach to Vadose Zone Monitoring at RCRA Facilities. Ground Water Monitoring and Remediation, volume 13, number 1.

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EPA, 1989. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance. Office of Solid Waste, Waste Management Division, Washington, DC. EPA/530-SW-89-026.

Geraghty & Miller, Inc. and ERM-Rocky Mountain, Inc. 1994a Revised Proposed Performance Criteria for the Engineered Barrier/Cover and Vadose Zone Monitoring System for the Solar Evaporation Ponds, Operable Unit 4 Interim Measure/Interim Remedial Action

Geraghty & Miller, Inc. and ERM-Rocky Mountain, Inc. 1994b "Proposed Performance Criteria for the Groundwater Monitoring System for the Interim Measure/Interim Remedial Action,Operable Unit 4, Rocky Flats Plant, Golden, Colorado.

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Attachment 5
5P307:0194:01
page 1 of 5

Proposed Performance Criteria for the Groundwater Monitoring System for the Interim Measure/Interim Remedial Action, Operable Unit 4 Rocky Flats Plant, Golden, Colorado

The proposed performance criteria for the groundwater monitoring system for the Interim Measure/Interim Remedial Action for Operable Unit 4 (OU4) at the Rocky Flats Plant are listed below.

1) **The monitoring system shall comply with appropriate regulations.**

Groundwater monitoring programs for interim status land units such as OU4 are regulated under 40 CFR (Resource Conservation and Recovery Act) Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities and Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste TSD Facilities. Statistical analysis of groundwater-quality data is governed by the EPA guidance document "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (February 1989).

2) **The groundwater monitoring system must be feasible to install, operate, and sample with respect to the site hydrogeology and selected engineered remedial alternative.**

It must be possible to install and access the wells included in the monitoring system. Individual components of the groundwater monitoring system must e compatible and appropriate for site hydrogeology and the selected remedial alternative.

3) **The groundwater monitoring system and access to the system must be integrated into the design and construction of the selected remedial alternative.**

The monitoring system must be integrated into the design of the selected remedial alternative, to the extent required, such that it does not substantially and unnecessarily interfere or compromise the integrity of the selected remedial alternative. Wells may be located within the perimeter of the site remedial alternative. These wells must be installed during construction of the alternative. Access to the wells must also be ensured. Sufficient room to perform well sampling also needs to be provided.

4) **The groundwater monitoring system shall consist of monitoring wells that must be constructed in accordance with "Technical Guidance for Groundwater Monitoring" (USEPA November, 1992).**

Well casing must be screened and the annulus filled with properly sized sand across the aquifer section(s) of concern. The annulus shall be filled with cement grout or bentonite slurry above the aquifer.

5) **Well replacement or maintenance shall be consistent with "Technical Guidance for Groundwater Monitoring" (USEPA November, 1992).**

The wells will require replacement and maintenance over time due to problems such as biological and sediment fouling of the screen. Well maintenance must be consistent to ensure that the groundwater-quality data is comparable over time. Well replacement and/or maintenance activities should not compromise the accuracy or precision of the groundwater quality data.

6) **The monitoring wells must be capable of yielding groundwater in sufficient quantity to provide groundwater samples for the required analyses (RCRA).**

The wells must be of a large enough diameter and be correctly screened to allow purging and sample collection in sufficient quantity to complete the required analyses. There may be limitations in groundwater yield due to the aquifer characteristics. To the extent possible, monitoring wells will be installed in locations that yield a sufficient flow and recovery rate.

7) **Samples from the monitoring wells shall provide groundwater-quality data from wells both hydraulically upgradient and downgradient of OU4.**

There shall be at least one upgradient well that is constructed in the appropriate aquifer and is not affected by OU4. There shall be at least three wells downgradient at the limit of OU4. The downgradient wells may be located either within OU4 or further downgradient than the limit of OU4 if sufficient justification can be provided. The downgradient wells shall be constructed in the appropriate aquifer and provide timely detection of constituents of concern that may have potentially migrated from OU4 to the aquifer. The location and number of wells shall be sufficient to provide groundwater-quality data representative of the entire upgradient and downgradient flow across OU4.

8) **A groundwater monitoring program shall be developed that includes protocols for groundwater sample collection, sample preservation and shipment, analytical procedures, chain of custody control, and threshold values that trigger a release response (RCRA).**

The groundwater monitoring protocol shall be a distinct document available to all personnel involved in the monitoring program. This document shall fully describe all tasks involved in the monitoring program.

9) **Groundwater-quality data and field parameters shall be developed to characterize drinking water parameters and constituents of concern (RCRA).**

There are two classes of analytical parameters, parameters characterizing the suitability of the groundwater as a drinking water supply and parameters used as indicators of groundwater contamination. Drinking water supply parameters are arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate (as nitrogen), selenium, silver, Endrin, Lindane, Methoxychlor, Toxaphene, 2,4-D, 2,4,5-TP silver, radium, gross alpha, gross beta, turbidity, and coliform bacteria. Groundwater contamination parameters may include, but are not limited to pH, specific conductance, plutonium, uranium, beryllium, cadmium, and nickel.

10) **Analytical data for groundwater contamination parameters shall be retained and analyzed statistically by a method approved by the USEPA (RCRA).**

Groundwater-quality data shall be analyzed to determine the relationship between groundwater quality upgradient and downgradient of OU4. Variations in groundwater-

Attachment 5
SP307:0194:01
page 5 of 5

quality data over time in individual wells shall also be analyzed. Data analysis shall be conducted by statistical methods approved in "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities" (USEPA February, 1989).

11) **Groundwater samples shall be collected and analyzed at a frequency consistent with selected statistical methods (RCRA).**

Statistically valid baseline and background values will be developed. The frequency of groundwater sample collection and analysis will be consistent with the selected statistical methods. A sufficient quantity of data will be collected both upgradient and downgradient of OU4 to permit statistical analysis of the data. Statistical procedures will be developed in the proposed monitoring plan.

12) **Statistically significant data variations shall be cause to initiate appropriate response actions (RCRA).**

Response actions are designed to determine the source of the data variation; such as analytical error, data mismanagement, groundwater impacts upgradient of OU4, and releases within OU4; and to correct the source of the variation. The responses may include notification of appropriate personnel and regulatory agencies; additional groundwater sampling and analysis; and appropriate release response actions.